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RESEARCH PAPER

Effect of Diclosulam pre-emergence herbicide on weed dynamics, yield and economics of groundnut (*Arachis hypogaea* L.)

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Abstract: A field experiment was conducted to study the effect of different high efficiency herbicides as pre- and post-emergence application on weed growth and yield of groundnut at AICRP on Groundnut, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka during *kharif* 2020. Among all the weed management practices, the broad-spectrum weed control with higher pod yield (2866 kg ha^{-1}), net returns (₹ 55156 ha^{-1}) and benefit-cost ratio (2.11) were obtained with diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS and next best option was diclosulam 84 % WDG @ 20 g a.i.ha^{-1} (PE) + Imazethapyr 10 % S @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS,.The phytoxicity rating of 1.0 was recorded wth diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) at10 days after sowing and there after it decreased and reached zero at 20 DAS.

Key words: Diclosulam, Groundnut, Imazethapyr, Pendimethalin

Introduction

Groundnut is an important oilseed crop of India which is cultivated in nearly 6 million ha area with the production of 7.5 MT and average productivity of 1.27 t/ha. Though India ranks first in the world under groundnut area and even though there is need to import 8.03 mt of edible oil. (Kalhapure *et al*. 2013). This is due to lower productivity. Weeds are the major cause of minimizing production and yield losses in groundnut to an extent of 13-80% (Jakhar and Sharma, 2015). For groundnut, there should be a weed free condition up to 40 DAS otherwise the reduction in growth and yield can't be compensated at later stage due to severe weed infestation. Thus, a field experiment as formulated to evaluate suitable integrated weed management practices for increasing weed control efficiency and reducing labour usage in groundnut production. At present, pendimethalin and oxyfluorfen are contemporary pre-emergence herbicides used in groundnut and many others crops (Jat *et al*., 2011) but are not very effective against broadleaved weeds However, new molecules that are environmentally friendly and more effective are being discovered and used as next-generation herbicides to address labour shortage, early weed control and reduce weeding costs. Diclosulam is a novel herbicide class of triazolopyrimidine sulphonamide, which is highly effective for the control of broad leaf weeds in a number of field crops and forestry applications (Singh, *et al*. 2009). It inhibits the enzyme Acetolactate synthase (ALS); stops cell division and weed growth. The use of Diclosulam as a pre-emergence herbicide resulted in effective control of broad-leaved weeds in soybean (Singh *et al*., 2009). Diclosulam is a triazolopyrimidine sulfonanilide herbicide registered for use in soybean [*Glycine max* (L.) Merr.] and groundnut and controls broad leaf weeds and nutsedge species. Diclosulam applied pre-plant incorporated (PPI) offers less risk and more consistent control than pre-emergence (PRE) applications which require rainfall or irrigation to move the herbicide into the soil where weed seed germination occurs (Grey and Wehtjw, 2005). Rao *et al.,* 2011, reported that diclosulam systems provided yields equivalent to metolachlor (Dual) followed by imazapic. Bailey and Wilcut (2002) reported that peanut yields were indicative of the level of weed management provided by diclosulam containing systems that included POST herbicides. Further, among the current using herbicides in groundnut, pendimethalin is the most widely used herbicide. But recently Government of India prepared a draft report to ban this herbicide. In order to test the efficacy of alternate chemicals, the present study on the use of diclosulam as pre-emergence herbicides in groundnut was planned. There are reports on the use of Diclosulam in groundnut and other crops in India as well as in other countries. Moreover, in Karnataka state testing efficacy of this new molecule in groundnut has not been initiated. Looking at the facts, the experiment was planned to manage the weeds in groundnut using Diclosulam.

Material and methods

Field study was conducted during *Kharif* 2020 at AICRP on groundnut, at main Agricultural Research Station, UAS, Dharwad. Soil type was black clayey soil (vertisols). The soil had a normal pH and was medium in available nitrogen, phosphorus, and potassium. The variety used for the study was GPBD 5 during *kharif* 2020. The crop was provided with basal application of FYM@ 7.5 t ha^{-1}, N:P:K @ 18:46:25 kg ha^{-1} and micronutrients namely FeSo4 and $ZnSO_4$ @ 25 kg each ha^{-1}. The gypsum @ 500 kg ha^{-1} was applied at the time of pegging *i.e.,* 45 to 50 days after sowing. The mean annual rainfall received during 2020 was 1012.9 mm distributed in 70 rainy days. The rainfall received during crop growth period (July - October) was 838.2 mm. The climatic conditions were favourable for the crop growth and development during the *kharif* 2020. There were fourteen treatments laid out in randomized block design (RBD) with three replications. Groundnut was sown on 15 July,

2020 with the spacing of 30 x 10 cm using seed rate of 150 kg ha^{-1} and the crop was harvested on 05 November 2020. Entire dose of nitrogen and phosphorus was applied as a basal dose at the time of planting. For nitrogen, phosphorus, and potassium, the fertilizers utilized were DAP and MOP. The treatments were T_1: Diclosulam 84 % WDG @ 15 g a.i. ha^{-1} (PE), T_2: Diclosulam 84% WDG @ 20 g a.i.ha^{-1} (PE), T_3: Diclosulam 84% WDG @ 25 g a.i. ha^{-1} (PE), T_4: Diclosulam 84 % WDG @ 15 g a.i. ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS, T_5: Diclosulam 84 % WDG @ 20 g a.i. ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS, T_6: Diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS. T_7: Diclosulam 84 % WDG @ 15 g a.i.ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i.ha^{-1} (PoE). T_8: Diclosulam 84 % WDG @ 20 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i.ha^{-1} (PoE),T_9: Diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i. ha^{-1} (PoE), T_{10}: Pendimethalin 30 % E.C.@ 1.0 Kg a.i.ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS, T_{11}: Pendimethalin 30 % E.C. @ 1.0 Kg a.i.ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i.ha^{-1} (PoE) at 18-20 DAS, T_{12}: Inter-cultivation at 15, 30 and 40 DAS, T_{13}: Weed free check and T_{14}: Weedy check.

Results and discussion

The experimental plot was mainly infested with broad-leaved weeds namely *Mollugo pentaphylla*, *Cyanotis cucullata*, *Corchoru solitorius*, *Parthenium hysterophorus*, *Commelina benghalensis*, *Phyllanthus maderapratensis*, grass*y* weed*s* namely *Dinebra retrflexa* and sedge namely *Cyprus rotundus.* Their occurrence and intensity varied in different treatments. Intensity of weeds varied due to application of different herbicides and manual weeding plots at different growth stages. The highest weed infestation was recorded in control (weedy check) plot. The weed intensity of all species significantly reduced by the application of herbicide either applied as pre or post-emergence at both stages of crop (20 and 40 DAS) growth. It might be due to application of diclosulam which was most effective to control the broad spectrum. Application of Diclosulam 84% WDG @ 25 g a.i. ha^{-1}(PE) + Imazethapyr 10 % SL @100 g a.i. ha^{-1}(PoE) at 18-20 DAS recorded significantly the lowest weed population of grassy as well as non-grassy weeds at both 20 and 40 days stage (Table 1). It was also observed that among the pre-emergence herbicides, the application of diclosulam effectively controlled both monocot and dicot weeds.The observations on weed density at 20 and 40 days after spraying of diclosulam 84% WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @100 g a.i. ha^{-1} (PoE) at 18-20 DAS (Table 1) revealed that significantly lower broad-leaf weeds density, grassy weed density and sedges weed density over the rest of the treatments. These results indicate that diclosulam 84% WDG @ 25 g a.i. ha^{-1}(PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1}(PoE) at 18-20 DAS was effective in controlling both broad-leaf weeds and grassy weeds,. Weed-free check at 20 and 40 DAS recorded significantly lower total weed density and total weed biomass and the next best control was pre-emergence application of diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @100 g a.i. ha^{-1} (PoE) at 18-20 DAS as compared other treatments.Application of diclosulam 84% WDG @ 25 g a.i. ha^{-1}(PE) + Imazethapyr 10 % SL @100 g a.i. ha^{-1}(PoE) at 18-20 DAS controlled all the categories of weeds, which in turn increased the yield attributes and yield of groundnut. The crop phytotoxic symptoms were recorded due to herbicide spray of diclosulam 84 % WDG @ 15, 20 and 25 g a.i.ha^{-1} (PE) at 10 and 20 DAS. The phytoxicity rating of 1 recorded at diclosulam 84 % WDG @ 25 g a.i.ha^{-1} (PE) at10 days after sowing and thereafter it decreased and reached zero at 20 DAS.

Effect on weed control efficiency

The data in (Table 2) showed at 20 and 40 DAS, higher weed control efficiency (80.68 %) was recorded with diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS, which was on per with T_8: Diclosulam 84 % WDG @ 20 g a.i. ha^{-1}(PE) + Imazethapyr 10 % SL @100 g a.i. ha^{-1}(PoE) at 18-20 DAS (79.52%) at crop maturity. Weed control efficiency ranged from 52.11 to 81.30 per cent in various treatments. Higher weed control efficiency in these treatments might be due to the lower dry weight of weeds. Weed competition was significantly reduced using weed control treatments due to differences in weed control efficiency by pre-emergence use of diclosulam, which was significantly superior to the remaining treatments. Due to more effective control of all the categories of weeds including predominant weeds. Nainwal *et al.,* (2010) and Vora *et al.,* (2019) also reported that pre-emergence application of pendimethalin followed by post-emergence application of imazethapyr at 25 days after sowing recorded higher weed control efficiency.

Effect on weed index

The data in (Table 2) showed that among the herbicide treatments, the lowest weed index (3.04 %) was recorded with D diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @100 g a.i. ha^{-1} (PoE) at 18-20 DAS which was on at par with diclosulam 84 % WDG @ 20 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @100 g a.i. ha^{-1} (PoE) at 18-20 DAS. The highest weed index (59.20%) was recorded by weedy check. Weed competition was significantly reduced by pre-emergence use of diclosulam, which was significantly superior to the remaining treatments suggesting that diclosulam offers a wide range of broadleaf weed control and that there is a positive effect of herbicide application on crop yield. Chandrika (2004), Dubey and Gangwar, (2012), Singh *et al*. 2019) and Har *et al*. (2020) that application of pre-emergence application of pendimethalin followed by post emegermce application of imazethapyr at 25 days after sowing recorded lower weed index.

Effect on yield attributes

The data in (Table 3) showed that significantly the highest number of pods (28.12) and shelling percentage (72.13 %) were recorded under weed free check. Among the different weed management treatments, significantly higher pod weight (27.47) and shelling percentage (71.75 %) was recorded with per-emergence application of diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS which was at par with diclosulam 84% WDG @ 20 g a.i. ha^{-1}

Table 1. Effect of different weed management practices on weed dynamics in groundnut

Treatments	Broad-leaf weed density (no./m²)		Grassy weed density (no./m²)		Sedges weed density (no./m²)		Total weed density (no./m²)		Total weed biomass (g/m²)	
	20 DAS	40 DAS	20 DAS	40 DAS	20 DAS	40 DAS	20 DAS	40 DAS	20 DAS	40 DAS
T_1	4.7 (20.79)	4.50 (19.22)	4.2 (16.29)	4.02 (15.20)	3.8 (13.54)	4.20 (16.61)	7.2 (50.62)	7.21 (51.03)	7.57 (56.34)	7.86 (60.87)
T_2	4.6 (20.20)	4.43 (18.63)	4.1 (15.69)	3.95 (14.60)	3.7 (12.94)	4.12 (16.01)	7.1 (48.83)	7.09 (49.24)	7.50 (55.37)	7.83 (60.34)
T_3	4.5 (19.23)	4.32 (17.66)	4.0 (14.72)	3.82 (13.63)	3.6 (11.97)	4.00 (15.04)	6.8 (45.92)	6.88 (46.33)	7.41 (54.01)	7.74 (58.98)
T_4	3.7 (12.96.)	3.52 (11.39)	3.1 (8.45)	2.89 (7.36)	2.6 (5.70)	3.13 (8.77)	5.3 (27.11)	5.34 (27.52)	6.82 (45.49)	7.13 (49.81)
T_5	3.6 (11.82)	3.36 (10.27)	2.9 (7.33)	2.69 (6.24)	2.4 (4.58)	2.94 (7.65)	5.0 (23.76)	5.02 (24.17)	6.64 (43.05)	7.05 (48.78)
T_6	3.3 (10.10)	3.09 (8.53)	2.6 (5.59)	2.34 (4.50)	2.0 (2.84)	2.63 (5.91)	4.4 (18.54)	4.46 (18.95)	6.61 (42.70)	6.94 (47.20)
T_7	3.2 (9.29)	2.95 (7.72)	2.4 (4.78)	2.16 (3.69)	1.7 (2.03)	2.47 (5.10)	4.1 (16.11)	4.18 (16.52)	5.79 (32.57)	6.57 (42.19)
T_8	3.0 (8.28)	2.78 (6.71)	2.2 (3.77)	1.92 (2.68)	1.4 (1.02)	2.25 (4.09)	3.7 (13.07)	3.80 (13.48)	4.51 (19.72)	5.17 (25.79)
T_9	2.9 (7.47)	2.63 (5.90)	2.0 (2.29)	1.69 (1.87)	1.1 (0.21)	2.07 (3.28)	3.4 (10.65)	3.47 (11.06)	4.38 (18.48)	4.97 (23.70)
T_{10}	4.1 (15.54)	3.87 (13.97)	3.5 (11.03)	3.31 (9.94)	3.0 (8.28)	3.51 (11.35)	6.0 (34.85)	6.02 (35.26)	6.90 (46.69)	7.22 (51.25)
T_{11}	3.9 (14.01)	3.67 (12.44)	3.2 (9.50)	3.07 (8.41)	2.8 (6.75)	3.29 (9.82)	5.6 (30.27)	5.63 (30.68)	6.95 (47.42)	7.21 (50.98)
T_{12}	4.3 (17.69)	4.14 (16.12)	3.8 (13.18)	3.62 (12.09)	3.4 (10.43)	3.81 (13.50)	6.5 (41.31)	6.53 (41.72)	7.38 (53.56)	7.71 (58.53)
T_{13}	1.0 (0.0)	1.00 (0.00)	1.0 (0.0)	1.00 (0.00)	1.0 (0.0)	1.00 (0.00)	1.0 (0.0)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
T_{14}	4.8 (21.84)	5.01 (24.13)	4.3 (17.33)	4.40 (18.38)	3.9 (14.58)	4.47 (18.98)	7.4 (53.75)	7.90 (61.49)	9.77 (94.61)	11.31 (126.88)
S.Em.±	0.22	0.22	0.22	0.31	0.22	0.21	0.65	0.70	1.60	1.63
C.D. at 5 %	0.63	0.66	0.63	0.91	0.63	0.60	1.90	2.05	4.64	4.75

Note: T_1: Diclosulam 84 % WDG @ 15 g a.i. ha^{-1} (PE), T_2: Diclosulam 84% WDG @ 20 g a.i.ha^{-1} (PE),
T_3: Diclosulam 84% WDG @ 25 g a.i. ha^{-1} (PE), T_4: Diclosulam 84 % WDG @ 15 g a.i. ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS,
T_5: Diclosulam 84 % WDG @ 20 g a.i. ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS ,
T_6: Diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS.
T_7: Diclosulam 84 % WDG @ 15 g a.i.ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i.ha^{-1} (PoE).
T_8: Diclosulam 84 % WDG @ 20 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i.ha^{-1} (PoE),
T_9: Diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i. ha^{-1} (PoE),
T_{10}: Pendimethalin 30 % E.C.@ 1.0 Kg a.i.ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS,
T_{11}: Pendimethalin 30 % E.C. @ 1.0 Kg a.i.ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i.ha^{-1} (PoE) at 18-20 DAS,
T_{12}: Inter-cultivation at 15, 30 and 40 DAS,
T_{13}: Weed free check
T_{14}: Weedy check.
PE: Pre-emergent PoE: Post emergent

(PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS (26.45). Significantly lower number of pods per plant was observed with weedy check (15.63).

Effect on groundnut pod and haulm yield

Among different weed control treatments (Table 3) the highest pod yield (2583 kg ha^{-1}) and haulm yield (2866 kg ha^{-1}) of groundnut was obtained with pre-emergence application of diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS which was closely followed by sequential diclosulam 84 % WDG @ 20 g a.i.ha^{-1} (PE) + Imazethapyr 10 % S @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS, which in turn increased the yield components and yield of groundnut. The pod and haulm yield of groundnut in weedy check plots were reduced to (1166 and 1413 kg ha^{-1}), respectively. Clewis and Wilcut (2004) indicated in their study that application of any peremregnce application of herbicide followed by post emergence application of any herbicide or hand wedding resulted in significantly superior yield components and yield. Significantly lowest Kernel yield (670 kg ha^{-1}) and 100-kernel weight (38.78 kg ha^{-1}) were recorded under weedy check and the highest were recorded under weed free check (Table 3). This could be attributed due to low crop-weed competition in this treatment. Among herbicidal treatments, Diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS efficiently increased kernel yield (1853 kg ha^{-1}) and 100-kernel weight (51.75g) which was found at par with its higher levels of weed free treatment. The increase in the kernel

Table 2.Weed control efficiency and weed index of groundnut as influenced by weed management practices at 20 and 40 DAS

Treatments		Weed control efficiency (%)		Weed index (%)
		20 DAS	40 DAS	
T_1	Diclosulam 84% WDG @ 15 g a.i. ha^{-1}(PE)	40.46	52.11	48.34
T_2	Diclosulam 84% WDG @ 20 g a.i. ha^{-1}(PE)	41.53	52.52	44.46
T_3	Diclosulam 84% WDG @ 25 g a.i. ha^{-1}(PE)	42.95	53.58	40.33
T_4	Diclosulam 84% WDG @ 15 g a.i. ha^{-1}(PE) + Inter-cultivation at 25 and 35 DAS	51.85	60.74	23.87
T_5	Diclosulam 84% WDG @ 20 g a.i. ha^{-1}(PE) + Inter-cultivation at 25 and 35 DAS	54.37	61.53	20.00
T_6	Diclosulam 84% WDG @ 25 g a.i. ha^{-1}(PE) + Inter-cultivation at 25 and 35 DAS	54.73	62.77	15.61
T_7	Diclosulam 84% WDG @ 15 g a.i. ha^{-1}(PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS	65.45	66.73	13.50
T_8	Diclosulam 84% WDG @ 20 a.i. ha^{-1}(PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS	79.52	79.65	7.23
T_9	Diclosulam 84% WDG @ 25 g a.i. ha^{-1}(PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS	80.68	81.30	3.04
T_{10}	Pendimethalin 30 % E.C.@ 1.0 Kg a.i ha^{-1}(PE) + Inter-cultivation at 25 and 35 DAS	50.63	59.68	32.57
T_{11}	Pendimethalin 30 % E.C.@ 1.0 a.i. ha^{-1}(PE) + Imazethapyr 10 % SL 100 g a.i. ha^{-1} (PoE) at 18-20 DAS	49.90	59.80	28.38
T_{12}	Inter – cultivation at 15 , 30 and 40 DAS	43.43	53.94	36.25
T_{13}	Weed free check	100.00	100.00	0.00
T_{14}	Weedy check	0.00	0.00	59.20
	S. Em.±	1.39	1.01	3.03
	C.D. at 5 %	4.04	2.95	8.80

Table 3. Yield, yield parameters and economics as influenced by weed management practices in groundnut

Treatments	Number of pods plant^{-1}	Shelling (%)	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Kernel yield (kg ha^{-1})	100 kernel weight (g)	Net returns (₹ ha^{-1})	B: C ratio
T_1	18.83	66.05	1375	1749	909	46.05	8105	1.17
T_2	20.30	66.87	1482	1879	993	46.87	12138	1.25
T_3	21.72	67.72	1590	1951	1077	47.72	16141	1.33
T_4	24.43	69.23	2028	2400	1403	49.23	33551	1.69
T_5	24.79	69.58	2139	2466	1487	49.58	37685	1.77
T_6	25.21	70.58	2250	2533	1586	50.58	41819	1.85
T_7	25.45	71.19	2311	2639	1645	51.19	44840	1.92
T_8	26.45	71.32	2472	2766	1763	51.32	51005	2.04
T_9	27.47	71.75	2583	2866	1853	51.75	55156	2.11
T_{10}	23.07	58.78	1806	2200	1091	41.20	23587	1.47
T_{11}	24.00	69.06	1917	2267	1323	49.06	27910	1.56
T_{12}	21.92	68.79	1698	2071	1167	48.79	20602	1.43
T_{13}	28.12	72.13	2660	2996	1918	52.13	57571	2.14
T_{14}	15.63	61.20	1166	1413	670	38.78	4006	1.09
S. Em.±	0.62	2.64	85.38	95.36	72.56	2.64	3455	0.07
C.D. at 5 %	0.81	7.68	248.20	277.2	210.93	7.68	10043	0.20

Note : T_1: Diclosulam 84 % WDG @ 15 g a.i. ha^{-1} (PE), T_2: Diclosulam 84% WDG @ 20 g a.i.ha^{-1} (PE),
T_3: Diclosulam 84% WDG @ 25 g a.i. ha^{-1} (PE),
T_4: Diclosulam 84 % WDG @ 15 g a.i. ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS,
T_5: Diclosulam 84 % WDG @ 20 g a.i. ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS ,
T_6: Diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS.
T_7: Diclosulam 84 % WDG @ 15 g a.i.ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i.ha^{-1} (PoE).
T_8: Diclosulam 84 % WDG @ 20 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i.ha^{-1} (PoE),
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T_{10}: Pendimethalin 30 % E.C.@ 1.0 Kg a.i.ha^{-1} (PE) + Inter-cultivation at 25 and 35 DAS,
T_{11}: Pendimethalin 30 % E.C. @ 1.0 Kg a.i.ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i.ha^{-1} (PoE) at 18-20 DAS,
T_{12}: Inter-cultivation at 15, 30 and 40 DAS, T_{13}: *W*eed free check and T_{14}: Weedy check.
PE: Pre-emergent PoE: Post emergent

yield (kg ha^{-1}) and 100 kernel weight (g) of groundnut was attributed to the decreased weed density and lesser biomass of weeds thus resulted in decreased competition by weeds to for moisture, light and nutrients.

Effect on economics

Significantly highest net returns (₹ 57571 ha^{-1}) was recorded with weed free-check and the lowest net return (₹ 4006 ha^{-1}) was recorded with weedy check. Among different weed

management treatments, significantly higher net return (₹ 55156 ha^{-1}) was recorded with T_9: pre-emergence application of Diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1} (POE) at 18-20 DAS, followed by T_8:Diclosulam 84 % WDG @ 20 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1} (PoE) at 18-20 DAS (₹ 51005 ha^{-1}) which were found equally good with weed free check.It wasdue to increas in pod and haulm yield of groundnut and reduced cost of weeding. Higher net returns with pre-emergence application of pendimethalin followed by post emergence application of imazethapyr resulted higher gross returns, lower cost of cultivation and higher net return were also reported earlier by Har *et al.* (2020). Further, lowest B:C ratio with weedy check and higher values with application of pre-emergence application of pendimethalin flowed by post emergence application of herbicides at 20 to 30 days after sowing was reported by Price *et al*. (2002) and Clewis and Wilcut (2004). The B:C ratio of groundnut cultivation was significantly influenced by different weed management practices. The highest benefit:cost of ratio was obtained with pre-emergence application of diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1}(PoE) at 18-20 DAS due to reduced cost of weeding and increased pod as well as haulm yield. Significantly lowest B:C ratio with weedy check and higher values with application of pre-emergence application of pendimethalin followed by post emergence application of herbicides at 20 to 30 days after sowing were also reported earlier by Price *et al.* (2002) and Har *et al*. (2020).

Conclusion

Effective weed control and higher pod yield of groundnut were possible with pre-emergence application of Diclosulam 84 % WDG @ 25 g a.i. ha^{-1} (PE) + Imazethapyr 10 % SL 100 g a.i. ha^{-1} (PoE) at 18-20 DAS which could be an alternative to present recommendation of Pendimethalin 30 % E.C.@ 1.0 a.i. ha^{-1} (PE) + Imazethapyr 10 % SL @ 100 g a.i. ha^{-1}(PoE) at 18-20 DAS.

References

Bailey W A and J W Wilcut 2002, Diclosulam systems for weed management in peanut (*Arachis hypogaea* L.).*Weed Technology*. 16:807-81

Chandrika, 2004, Integrated weed management in groundnut (*Arachis hypogaea* L.) during *Rabi* season. *Legume Research*, 27(4): 243-238.

Clewis S B, and Wilcut J W, 2004, Economic assessment of diclosulam and flumioxazin in strip- and conventional tillage peanut. 26th Southern Conservation Tillage Conference 296-303.

Dubey M, and Gangwar S, 2012, Effect of chemical weed control of imazethapyr (Pursuit) in groundnut var. 'TG- 24'. *Plant Archives,* 12(2): 675- 677.

Grey T L and Wehtje G R, 2005.Residual herbicides weed control in peanut. *Weed control,* 19:560-567.

Har N M, Ranjeet S Y, Navin K J and Mayank Y, 2020, Anovel pre-emergence herbicide (Diclosulam) as an environmentally friendly weed management option in peanut and its Phytotoxicity evaluation. India. *Weed Biology and Management*, 21:19-27.

Jakhar R R and Sharma R, 2015. Growth and yield attributes as influenced by integreated weed managementmax in Soybean, (*Glycine max* L.) Merill. *Annals of Biology,* 31(2):190-194.

Jat R S, Meena H N, Singh A L, Surya J N & Misra J B, 2011, Weed management in groundnut (*Arachis hypogaea*) *in Indian, Agricultural Reviews*, 32 (3): 155-171.

Kalhapure A H, Shete B T and Bodake P S, 2013, Integration of chemical and cultural methods for weed management in groundnut. *Indian Journal of Weed Science,* 45(2): 116-119

Main C L, Ducar J T and Mac Donald G E, 2002, Response of three runner market-type peanut cultivars to diclosulam. *Weed Technology*, 16:593-596.

Nainwal R C, Saxena S C and Singh V P, 2010, Effect of pre and post-emergence herbicides on weed infestation and productivity of soybean. *Indian Journal of Science*, 42: 17 - 20.

Price A J, Wilcut J W and Swann C W, 2002, Weed management with diclosulam in peanut (*Arachis hypogaea*) *Weed Technology*. 16:724-730.

Rao S Madhavi M and Raghava Reddy C, 2011, Integreated weed management in winter season groundnut (*Arachis hypogaea* L.) *Journal of Oilseeds Research,* 28(1): 57-59.

Singh S P, Singh V P, Nainwal R C, Tripathi N and Kumar A 2009, Efficacy of diclosulam on weeds and yield of soybean. *Indian Journal of Weed Science*, 41(3 - 4): 170- 173.

Singh S P, Yadav R S, Godara S L, Amit Kumawat and Birbal, 2019, Herbicidal weed management in groundnut (*Arachis hypogaea*), *Legume Research,* 42(6): 829-833.

Vora V D, Parmar A D, Hirpara D S, Kanzaria K K, Desai N R, Kaneria S C and Modhavadiya V L, 2019, Weed management in *Kharif* groundnut. *International Journal of Current Microbiology and Applied Science,*8 (11): 429 - 434.